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Title: A HISTORY OF THE RADIOACTIVE WASTE MANAGEMENT COMPLEX AT THE IDAHO NATIONAL ENGINEERING LABORATORY

Organization: WASTE MANAGEMENT PROGRAMS DIVISION
RWMC OPERATIONS BRANCH

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RADIOACTIVE WASTE MANAGEMENT COMPLEX
AT THE
IDAHO NATIONAL ENGINEERING LABORATORY

1. INTRODUCTION

The Radioactive Waste Management Complex (RWMC) is located within the Idaho National Engineering Laboratory (INEL), formerly the National Reactor Testing Station (NRTS). The INEL covers 2315.5 km^2 of semiarid land in southeastern Idaho near the center of the eastern Snake River Plain. The U.S. Atomic Energy Commission (AEC), now the U.S. Department of Energy (DOE), established the NRTS in 1949 as a site for building and testing various types of nuclear facilities.

Major waste management developments, decisions, and practices at the RWMC after the site was selected fall into the following time periods: early disposal (1952-59), interim burial ground (1960-63), mid-to-late 60s (1964-69), and 1970-to date. These periods are presented as the major sections of this report. Appendix A contains a listing of terminology changes and an explanation of acronyms used throughout the report. Appendix B is a listing of conversion factors.

Information for this report was drawn primarily from existing records and reports. Available information on the earliest years was somewhat limited since much of the documentation concerning operation at the RWMC before 1970 was destroyed when the required retention period had been exceeded. Table 1 presents a chronological listing of the changes in waste management responsibilities of the government and contractor. Table 2 summarizes the known RWMC developments and facility additions by year.

TABLE 1. HISTORY OF BURIAL GROUND ADMINISTRATION

Year	ID	Contractor
1952	Health Physics Division Site Survey Branch was responsible for operation of Burial Ground and environmental monitoring. Idaho Operations Office (ID) division of Engineering and Construction (ID-E&C) drew up burial plot plans.	National Industrial Maintenance Co. (NIMCO) was responsible for excavation, unloading, and burial work and Central Facilities maintenance (1949-53). E. B. Steele Co. was responsible for surveying.
Fall 1953		Lost River Transportation Co. was responsible for Central Facilities maintenance.
1953-1966 Energy Chemical E&C.		Phillips Petroleum Co. (PPCo) Atomic Division was responsible for Central Facilities maintenance and Idaho Processing Plant (ICPP); absorbed ID-
1953	Health and Safety Division (ID-H&S) was formed from ID Health Physics Safety Branch and Fire Department. Site Survey Branch still was responsible for Burial Ground and onsite radioactive waste disposal.	F. C. Torkelson Co. was responsible for surveying and architectural engineer contract for Site.
1960-1963 AEC.		PPCo became waste-receiving agent for
1961		PPCo assumed responsibility for health physics supervision at Burial Ground.
1962 Ground.	AEC-ID was responsible for Burial Ground management.	PPCo Health and Safety was responsible for operation of Burial
1962		PPCo Nuclear Safety Committee was responsible for nuclear safety rules.

TABLE 1. (continued)

Year	ID	Contractor
1966		Idaho Nuclear Corporation (INC) (formed as a joint subsidiary of Aerojet-General Co. and Allied Chemical Corporation) was responsible for Burial Ground. Absorbed F. C. Torkelson Co., as INC Architect-Engineering Branch. CPP-HP made receiving agent for offsite waste.
1967	ID-H&S was reorganized into ID Health Services Laboratory (ID-HSL) and ID Operational Safety and Technical Support (ID-OSTS) Division; Environmental Branch of ID-HSL was responsible for technical direction of solid waste burial. Hazards Control Branch of ID-OSTS was responsible for health and safety surveillance.	
1969		INC reorganized; PPCo became a part owner. Nuclear and Operational Safety (NOS) Division (combined H&S Branch, Operations Surveillance Branch, and Nuclear Safety Committee) was responsible for independent internal review of burial operations.
1970	Waste Management Branch was formed in Nuclear Technology Division (NT-ID) and assumed responsibility for Burial Ground management.	NOS was responsible for all INC waste management and pollution control. In late 1970, that responsibility was transferred to Chemical Programs Division.

TABLE 1. (continued)

Year	ID	Contractor
1971 services		Aerojet Nuclear Co. (ANC) became contractor for operating the RWMC. Technical operation of the RWMC was transferred from Aerojet Safety Division to Waste Management Programs to ensure independent auditing capability.
1975	Energy Research and Development Administration (ERDA) replaced the AEC and assumed responsibility for radioactive waste management at the INEL.	
1976		EG&G Idaho, Inc., (EG&G) replaced ANC as INEL prime contractor.
1977	Department of Energy (DOE) replaced ERDA and assumed responsibility for radioactive waste management at the INEL.	

TABLE 2. BURIAL GROUND DEVELOPMENTS AND FACILITY ADDITIONS

Year	Facilities and Equipment Installed	Major Developments
1953	--	Original 5.2 ha of Burial Ground fenced
1954	--	Rocky Flats waste shipped to RWMC Transuranic waste from Rocky Flats received visual survey *Ground cover placed over filled trenches periodically*
1957	--	Burial Ground expanded to 35.2 ha Pit disposal begun to accommodate large and bulky waste TRU waste placed in separate pits
1953	--	NRTS flood control project constructed on Big Lost River, adjacent to Burial Ground--including diversion dam and spreading areas
1960	--	HSL established ten monitoring holes drilled to the basalt adjacent to waste-filled excavations
1960-63	--	Procedures for acceptance of shipments and standardized forms adopted
1962	--	System of dikes and ditches constructed around Burial Ground Diversion dike for Big Lost River constructed by diking spreading area HP technician assigned duty to guide operation, witness disposal, and sign records showing disposal made
1963	--	Began random dumping of Rocky Flats waste in pits instead of stacking.

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1966	--	Minimum soil cover over buried waste increased from 0.6 to 0.9 m Minimum trench depth increased from 0.9 to 1.5 m Heavy metal plate used for compaction Fire protection improved Waste covering at end of week required
1969	--	Extensive dike system constructed to protect Burial Ground from runoff in local drainage basin Temporary grading and diking provided inside Burial Ground to control internal drainage Stacking of waste from Rocky Flats reinstituted
1970	--	RWMC expanded to 57.6 ha when 22.4-ha TSA was added Burial of TRU waste discontinued; TRU waste stored aboveground on asphalt, then covered with layers of plywood, plastic, and soil Diking around SDA completed At least 0.6 m of soil placed over bedrock at bottom of new pits and trenches
1971	Burial Ground trailer TSA change trailer Forklift truck, backhoe, and crane	RWMC land graded to provide major drainage channels for surface water Waste carried by ATMX cars, improved rail shipment carriers Stacking mechanized with hydraulic-cylinder unloader Computerized Waste Management Information System implemented Fire Protection Plan instituted Equipment and personnel permanently assigned to the RWMC

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1972	Dozer/scraper to cover Rocky Flats waste on ITSA pad Second access road for emergency use to west end of the RWMC	Waterproofing of ITSA pad upgraded ITSA pad extended 76.2 m Upgrading of containers initiated, i.e., new steel drums painted white TDA pad established for surface disposal of waste with less than 10 nCi/g of transuranic nuclides Emergency Action Plan completed
1973	Mobile yard ramp and four forklift trucks	Training program for operators and supervisors at Burial Ground initiated TRU combustible and noncombustible waste packaged separately Environmental Surveillance Plan formulated Sampling of small mammals and soil outside SDA begun Measuring of temperature and humidity in ITSA storage configuration implemented Drainage of RWMC upgraded Machine compression test on ten 208.2-L steel drums performed Burial Ground subsurface water monitoring plan begun
1974	BORAX V building for storage of Waste Management material ITSA exclusion fence WMF-601 WMF-602 Decontamination Facility South Decontamination Facility evaporation pond fenced	Two 18 925-L water storage tanks installed under ground for fire-protection purposes Plywood boxes covered with fiberglass-reinforced polyester (FRP), and steel drums lined with 0.23-mm polyethylene liners Initial Drum Retrieval (IDR) Program begun (1974-78) Most onsite waste transported in plastic bags for compaction

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1974 (cont)	Hydraulic, bale-type compactor installed in Equipment and Compactor Building for volume reduction of waste before disposal Perimeter electrical monitoring power around RWMC and evacuation alarm system installed Railroad spur to TSA completed providing direct shipment of waste to RWMC Air support structure placed over IDR Second TSA storage pad	Bioassay program initiated Radiation survey of grounds mechanized Computerized Transuranic-Contminated Waste Container Information System (TCWCIS) developed and implemented
1975	TSA air-support weather shield (ASWS) TSA instrusion alarm system 362.9-kg-capacity front-end loader and hydraulic excavator TSA-2 pad extended TDA pad (Pad A) extended	Metal corrosion coupons placed with stored waste in TSA Soil level raised above SDA pits and trenches to exclude moisture accumulation (1975, 1976, 1978)
1976	Intermediate-Level Transuranic Storage Facility WMF-603 water storage tank and pumphouse Air-support weather shield for EWR project TSA-R pad constructed and placed in operation SDA sump pump installed Movable Operating Area Confinement (OAC), including change booths, fire protection equipment, and air moving and filtering equiment used for retrieval in ASWS for EWR	Early Waste Retrieval project started Flora and fauna studies started

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1976 (cont)	Cherry picker Excavator 59-metric ton crane Front-end loader Water spray trailer Two flatbed trailers One air compressor	
1977	WMF-604 RWMC change and lunch facility	Cell monitoring instruments installed to measure temperature and humidity in TSA-1
	Soil vaults	
	Standby electrical power	
	TSA pad sweeper Dump truck Ten-wheel flat bed truck Earth tamper Water spray trailer Air compressor (breathing type)	
1978		Operating procedures standardized
	7570-L water truck 40.8 metric ton crane Earth scrapers Rough-terrain forklift	Offsite and onsite packaging criteria standardized and issued to replace Letters of Agreement with waste generators
	Additional vaults for ILTSF	Training guidelines and evaluation program established
		Health physics monitoring program improved
		Site characterization instrumentation program improved
		Core sampling for subsurface studies of 1972-78 initiated and continued
		Flora and fauna studies of 1977-78 improved
		Air monitoring of 1974-78 improved
		Additional soil stabilization and moisture exclusion initiated (0.6 to 0.9 m of soil cover over previously buried TRU waste)
		Fire testing of FRP boxes

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1979	Twenty 61-cm-dia. ILTSF vaults; five 40.6-cm-dia. ILTSF vaults	Bottom-discharge Cask Design Guidelines issued
	Radiation Analysis Laboratory (RAL) in WMF-601	Removal of basalt in disposal area initiated to increase disposal space
	Heavy Equipment Storage Shed (HESS), WMF-609	Fire testing of FRP boxes, plywood boxes, and metal boxes
	ILTSF pad area expanded	
	Dozer with ripper	
1980	Discrete sumps and drainage facilities on TSA-2	Testing of explosive fracturing of basalt in SDA--scale-model tests outside RWMC and in Pit 17
	Fifteen 61-cm-dia. and five 40.6-cm-dia. ILTSF vaults	Conceptual designs and estimates completed on large (54.4-metric ton) bottom-discharge cask
	New fire pumps and piping systems in WMF-603	Relocation of Air Support Weather Sheild to Cell 3, TSA-2
	1.3-m soil vault sleeve	Disposal of ANL-E low-level waste commenced
	Firehose cart with 304.8 m of reeled hose	
	Two 11.5-m^3 dump trucks	
	Front-end loader	
	ASWS block-lifting fixture	
	55.95-W turbine pump to replace original RWMC deep-well pump	
1981	Dry-pipe fire mains to TSA and SDA; and fire sprinkler systems in WMF-602, -603, and -609	First production-scale explosive rock fracturing; 2977 m^3 of basalt fractured and removed from Pit 17.

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1981 (cont)	Ultraviolet (fire) detection system installed in ASWS-2 and around Pit 16	Fire-retardant paint testing
	Guardhouse (WMF-611) under construction	Thermal testing of ILTSF vaults
	Production deep well pump installation and testing completed	Water removed from ILTSF vaults before drying and resealing the vaults
	Five, 40.6-cm-diameter and twenty-two 61-cm-diameter ILTSF vaults installed with shield plugs and radiation-monitoring tubes	SDA acid pit sampled; presence of waste radionuclides or other toxins not indicated by analyses of soil samples
	Cylindrical concrete monuments to replace damaged old-style monuments	Monitoring potentially flammable gas in TSA cells
	Liquid Corrosive Chemical Disposal Area (LCCDA) closed	TRU waste shipments stacked in designated sections on ASWS-2
	Weighing lysimeter data logger and weather station installed and tested	
	Water storage tank interior sandblasted and repainted	
	127-metric ton Manitowoc crawler-mounted crane	
	ASWS-3 deflated and stored	
1982	Motion-detection system installed in ASWS-2	RWMIS, TCWCIS, and SWIMS converted to NOMAD VP/CSS data base management system
	Guardhouse (WMF-611) completed	PWMC flooded by rapid snowmelt
	Decontamination Facility South (DFS) (WMF-602) decomtaminated and decommissioned then redesignated Operational Support Facility (OSF)	Flood-control upgrade
		Explosive rock-fracturing; 14 196.1 m^3 of basalt fractured and removed from Pit 17; 22 950 m^3 of basalt fractured in second FY 1982 blasting but not removed at end of FY 1982
	Radiography room and equipment installed in OSF for examination of drums and boxes of waste (a Waste Experimental Reduction Facility (WERF) project)	Hydrogen explosion testing (mock-up, 208.2-L waste drums)
		Thermal testing of ILTSF vaults

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1982 (cont)	Twenty-two, 61-cm-diemeter and ten, 40.6-cm-diameter ILTSF vaults installed; twelve, 121.9-cm-diameter ILTSF vaults procured for NWCF filters	New definition of TRU-contaminated material
		Soil sampling to detect trace elements or organics that could be transported by air to beyond the RWMC boundary
	Rotary snow-blower	Russian thistle samples
	7.3-metric ton, rough-terrain, extendable-boom, LOED forklift	Rock-fracturing tests using BRI-STAR and freezing water
	5.4-metric ton forklift	
	1.8-metric ton forklift	
	11.5-m^3, heavy-duty dump truck	
	49.9-metric ton, bottom-discharge cask	
1983	IH 11.5-m^3 dump truck	Explosive rock-fractfuring; 22,950 m^3 of basalt fractured in pots 18 and 19
	White 29.9-metric ton truck tractor	
	Hyster 2722-Kg forklift	Offsite and onsite packaging criteria were reviewed and combined into two DOE-ID documents
	Toyota 1814-Kg forklift	Quality Assurance Program Plans were prepared by each waste generator and approved for TRU waste shipments to the RWMC
	Kohler 50 Kw generator set	
	Jeep dolly	New drain culvers from north SDA external drain channel to main RWMC external drain channel installed. Explosive rock fracturing in main drain channel between RWMC and Adams Blvd. completed
	2-Trailers, 36-metric ton, flat deck	
	2-Trailers, 32-metric ton, folding deck	
	Light generator trailer	Environmental assessments performed for wind gaps dikes 1 and 2 raised approximately six feet
	Four 40.6-cm-diameter, twenty 61-cm-diameter and twelve 121.9-cm-diameter ILTSF vaults installed	

TABLE 2. (continued)

Year	Facilities and Equipment Installed	Major Developments
1983 (cont)	Visitor parking lot paved, exterior to Guard Post, WMF-611	
	New TSA/SWEPP access bridge installed	
	TSA-3 asphalt pad installed	
1984 thru July 1985	Soil vacuum, truck mounted	Explosive rock-fracturing; 24,092 m^3 of basalt fractured in pits 19 and 20. The broken rock was placed as rip-rap on flood control dike number-1 and 2 (July 1, 1984).
	2 trailers, 36-metric ton, flat deck	
	Railcar mover	RWMC Spill/Decon Plan approved
	SWEPP, 2.7 metric ton forklift (LP)	Automated TRU Waste Interim Tracking System developed and implemented
	Radiation Analysis Lab decommissioned	
	SWEPP and C&S buildings completed	Spreading Are Flood Control Dike No. 1 raised six feet, and Dike No. 2 eight feet
	The two south bays of the HESS enclosed	Productivity measurement system implemented and automated
	WVRF compactor filtered exhaust system modified to discharge outside the building	SWEPP operational August 1, 1985
	Bulk disposal crane pad constructed	*Geotextile use in pit floor implemented*
	SWEPP Scales (2268Kg)	

2. EARLY DISPOSAL PRACTICES (1952-59)

2.1 Waste Disposal Site Selection

The AEC recognized the need to develop a local disposal ground for the solid, radioactively contaminated waste that would be generated during the operation of nuclear reactors and associated facilities at the National Reactor Testing Station. The United States Geological Survey (USGS) was consulted in the selection of a disposal site on the NRTS. The disposal site was selected in 1951 according to the following criteria:[1,2]

a. An area of not less than 4 ha

b. Accessibility without extensive road construction

c. An area with not less than 4.6 and preferably 6.1 m of unconsolidated sedimentary overburden on the bedrock. (At that time the personnel selecting the site believed that trenches would be 3.7 to 4.6 m deep and that waste materials would be covered with at least 1.8 m of soil.)

d. Appreciable amounts of clay in the burial sediments, especially in the beds below a depth of 3.7 m. A USGS letter[1] stated that there should be at least several feet of sediment under the buried material to slow the downward percolation of gravitational water and to assist natural absorption of radioactive solids dissolved in circulating water. The letter stated that appreciable amounts of clay in the sediments would facilitate natural absorption.

e. Overburden sufficiently cohesive to stand a short period in vertical or nearly vertical walls

f. An area not directly up the groundwater stream from existing or potential reactor sites or other places where water production wells may be drilled.

g. Good surface drainage, leading away from existing or potential installations or water production sites.

A 40.0-ha area, located in the southwestern corner of the NRTS and characterized by fine-grained sediments deposited by the Big Lost River, was proposed for disposal operations. In May 1952, a 5.2-ha tract of this area was established as the NRTS Burial Ground for solid waste disposal.[3,4] At that time, AEC was also considering the area as a disposal site for solid waste generated at nuclear facilities in other parts of the country.[5] The Burial Ground site is located in Section 18, T2N, R29E, 3.2 km southwest of the Experimental Breeder Reactor-I (EBR-I) site, 8.1 km west of the Central Facilities Area, and 25.7 km southeast of Arco (see Figure 1).

2.2 Early Environmental Monitoring

Before the introduction of any radioactive material at the NRTS, extensive detailed information had been obtained between 1949 and 1950 on the natural background radiation. This environmental appraisal included evaluations of the effects of naturally occurring radionuclides in air, water, soil, and vegetation, and on predominant wildlife. The study established a base line against which quantities of radionuclides originating from reactor operations could be recognized easily and appraised.[6]

From the beginning of waste disposal, portable instruments had been used for direct monitoring, visual inspections, and surveys of the excavation areas. Although no routine air samples were taken in connection with the Burial Ground, an air-monitoring network throughout the NRTS and offsite had been maintained by AEC ID-HSL since the NRTS was first established by AEC-ID.[7]

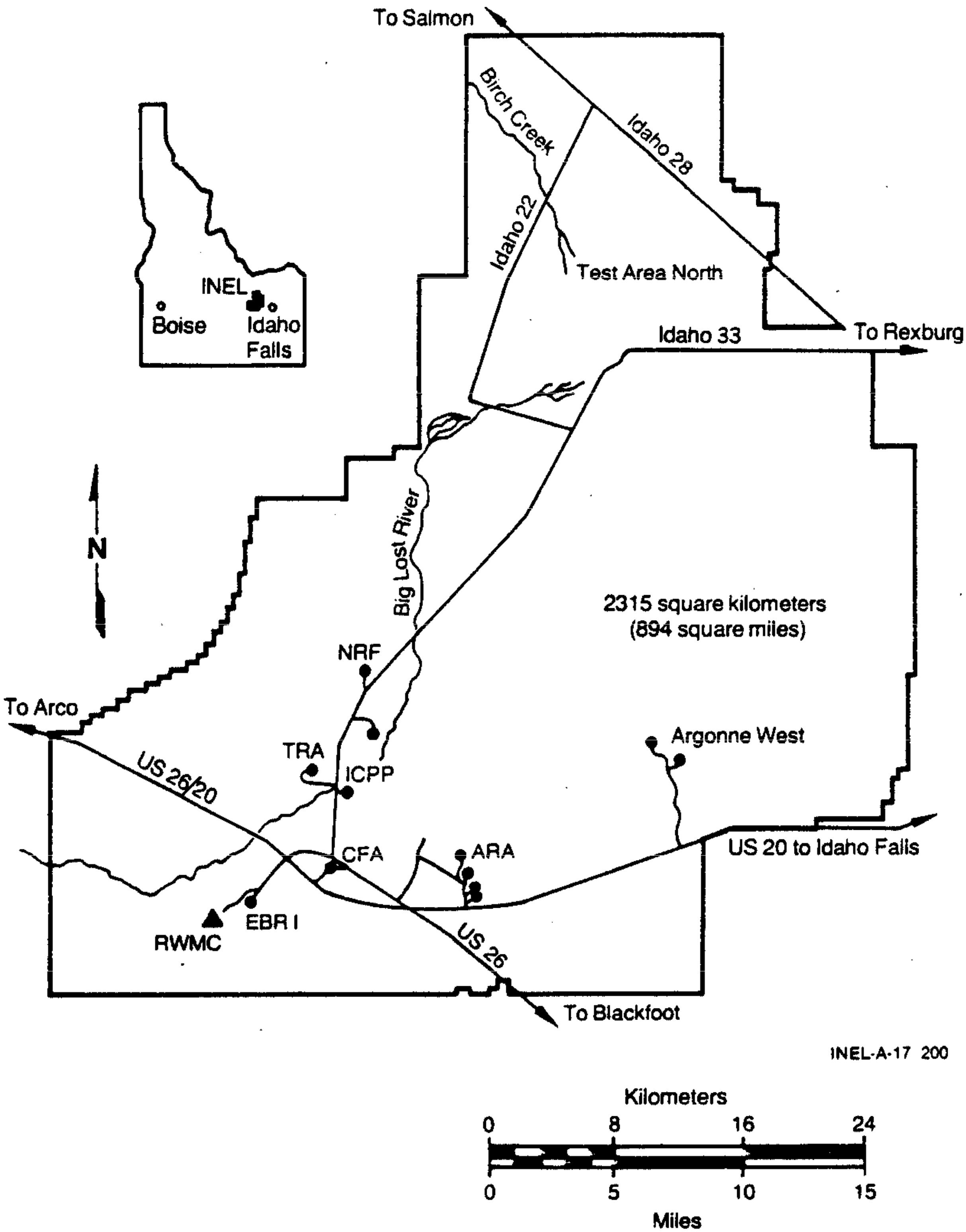

Figure 1. Location of Burial Ground (RWMC) at INEL.

2.3 Geology and Hydrology of the Burial Ground

During 1952, the USGS performed an investigation of the geology and hydrology of the larger 40.0-ha area.[3,5] A USGS report, published in 1953,[5] stated that the area was generally favorable for the disposal of limited quantities of short-lived radioactive waste and that its sediments would have greater ion-exchange capacity than sediments nearer the Big Lost River. The report noted that surficial sediment was more than 2.7 m thick over much of the site. AEC approved the site location since it met most of the original criteria for a suitable burial site.[3]

The 1953 USGS report also suggested that water in contact with contaminated material might carry contaminants downward to the water table. However, contamination was thought unlikely since percolating water would be subject to ion-exchange processes, and local precipitation would contribute little recharge water.

2.4 First Trench Burials

On July 8, 1952, the first trench was opened for the disposal of mixed-fission-product (MFP) waste generated at the NRTS. The MFP waste consisted mainly of contaminated paper, laboratory glassware, filters, and metal pipe fittings.[3] Although the Burial ground was designated for disposal of solid waste, one report[5] states that certain liquids in sealed containers were placed in the first trench.

Between 1952 and 1957, Trenches 1 through 10 were excavated to basalt.[8,9,10] These early trenches were approximately the same size, averaging 1.8 m wide, 274.3 m long and 3.7 m deep.[9] Spacing between these trenches ranged from 3.4 m up to 18.3 m.[10] Table 3 lists the opening and closing dates of trenches at the Burial Ground.

The Burial Ground was enclosed almost immediately with a barbed wire fence. Metal tags placed on the fence served as the sighting devices to mark trench locations.

TABLE 3. OPENING AND CLOSING DATES OF PITS AND TRENCHES[10]

Trench Number	Date Opened	Date Closed	Trench Number	Date Opened	Date Closed
1	07-08-52	10-01-54	40	10-07-65	01-13-66
2	10-01-54	12-21-54	41	01-04-66	10-04-66
3	12-22-54	04-22-55	42	05-09-66	01-16-67
4	04-22-55	11-21-55	43	10-20-66	06-01-67
5	11-04-55	03-29-56	44	01-13-67	03-24-67
6	03-22-56	09-04-56	45	02-28-67	09-27-67
7	08-14-56	12-20-56	46	09-25-67	03-14-68
8	12-13-56	05-07-57	47	02-28-68	08-05-68
9	01-17-57	09-06-57	48	08-08-68	05-02-69
10	07-19-57	02-07-58	49	11-18-68	06-30-69
11	02-11-58	07-25-58	50	07-01-69	11-01-69
12	01-03-58	01-16-59	51	10-30-69	04-08-70
13	01-09-58	04-24-59	52	03-04-70	07-04-70
14	04-16-59	07-30-59	53	07-01-70	10-12-70
15	07-31-59	10-16-59	54	09-23-70	05-04-71
16	10-17-59	04-12-60	55[a]	04-07-71	03-12-82
17	11-01-59	07-01-60	56	12-29-71	02-01-73
18	05-10-60	07-20-60	57	12-28-72	06-11-74
19	07-05-60	11-29-60	58	02-20-74	08-17-81
20	12-01-60	06-30-61			
21	12-13-60	01-10-61	Pit Number		
22	02-01-61	04-25-61	1	11-01-57	10-01-59
23	06-20-61	09-15-61	2	10-01-59	07-01-63
24	10-01-61	07-31-62	3	12-15-61	01-03-63
25	08-01-61	07-27-62	4	01-03-63	09-26-67
26	04-13-62	08-17-62	5	06-18-63	12-22-66
27	08-20-62	01-04-63	6	05-18-67	10-22-68
28	12-26-62	03-12-63	7	09-19-66	10-05-68
29	11-19-62	03-20-63	8	03-06-67	11-00-69
30	03-02-63	09-12-63	9	11-08-67	06-09-69
31	03-25-63	11-22-63	Acid Pit	01-01-54	01-01-61
32	04-01-63	11-18-63	10	08-07-68	07-08-71
33	10-11-63	08-11-64	11	04-14-70	10-16-70
34	03-18-64	08-27-64	12	07-02-70	09-12-72
35	08-28-64	01-19-65	12	07-20-71	07-29-74
36	12-01-64	07-24-65	14	07-01-74	03-31-76
37	12-24-64	07-01-65	15	06-25-75	07-05-84
38	05-15-65	09-16-65	16	05-22-68	Still open
39	07-20-65	11-05-65	17	08-20-82	Still open

a. Trench 55 was closed administratively 03-12-82 due to unknown conditions at the east end of the trench.